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Book Review

STRATEGIES AND TACTICS OF HUMAN BEHAVIORAL RESEARCH

By J. M. Johnston and H. S. Pennypacker

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The most important aspect of a science is its experimental methodology. An inadequate method for data collection and evaluation inevitably leads to inadequate data. While some findings of interest could accidentally be indicated by inadequate data, the most usual outcome is either, at best, information with absolutely no value or, at worst, information that is misleading.

Fortunately, the science of behavior began in the traditions of earlier physical and biological sciences. It adopted an experimental methodology which led to valuable findings. This methodology, like that of its precursors, stressed precise definition of the subject matter, careful measurement, and design arranged to identify orderly relationships among the subject matter and other phenomena under study. For a science of behavior, this methodology allowed for the determination of functional relationships between the behavior of individual organisms and particular environmental influences.

The success of these strategies led to some rather fortunate outcomes. Behavior was found to be an orderly subject matter. Several powerful classes of independent variables were identified and their effects on individual behavior were examined. A collection of data became available which was so convincing that scholars in the field found that some inductively derived theoretical positions could be defended. Finally, some of the classes of independent variables seemed to account for the existence of certain human behavior which when established or eliminated could solve some important human concerns.

It was from this last outcome that the applied analysis of behavior was formed. Researchers adopted the experimental methodology of the laboratory and began to investigate socially important human behavior. These researchers questioned whether the same classes of independent variables had similar types of effects on human behavior as they had on animal behavior. A science of behavior had made a significant advance in seeking the generality of its findings.

The applied analysis of behavior began with the same experimental methodology as the experimental analysis of behavior. The only major difference was that the dependent variable was to be socially important human behavior. Applied behavior analysis was successful and with this success began a period of rapid growth. Researchers from other disciplines were attracted to the field. New training programs began. New journals were founded. Applied behavior analysis was firmly established as a unique field of inquiry.

While the success of the science of behavior led to mostly favorable outcomes, not the least of which was applied behavior analysis, the very rapid success of applied behavior analysis has led to certain outcomes which need to be carefully examined before their value can be determined. Along with growth came some significant changes and these changes have influenced the very direction of the field. Among the most significant changes was a shift in the purpose of the

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research being conducted under the label of applied behavior analysis.

The initial thrust of applied behavior analysis was to identify and study the variables responsible for socially important human behavior. Under a variety of influences, however, the field has moved toward the development of technologies for modifying those behaviors. Rather than primarily studying the variables of which socially important human behavior is a function, many scholars in the field began to concentrate on applying these variables to new or unique social problems in an attempt to improve the social situation. Research in the field moved from investigation toward evaluation, from a science of behavior toward a technology of behavior-change (for detailed examinations of these issues see Azrin, 1977, and Deitz, 1978).

Many influences hastened this transition. Most importantly, the initial studies of functional relationships *also* improved the social problem. The ability to immediately improve society enticed new professionals to the field. The primary interest of these professionals was to apply an effective behavioral technology to the problems they had identified in clinical psychology, education, business, and so forth. Solving these pressing needs seemed more important than uncovering the variables producing the problems. Discerning the many, often subtle, influences on important human behavior, while not forgotten, was subjugated by the combinations of proven variables which could be imposed on the current contingencies in the applied setting to improve behavior.

This shift in the primary emphasis of research in applied behavior analysis is important to examine for several reasons. One may question whether enough is known about the influences of these variables on human behavior. In other words, is sufficient information yet available to support a technology? That question is debatable and unimportant for the purpose of this review. A more important question is does this shift in purpose affect any ongoing practices in the field? In one essential area, traditional practices do seem to have been significantly affected.

The area most influenced by a shift in purpose is experimental methodology. Many changes have occurred (see Hayes, Rincover, & Solnick, 1980) and if one accepts the opening sentence of this review, these changes require careful consideration. They permeate all aspects of the methodology currently practiced in applied behavior analysis. Response definitions are almost exclusively topographical; when individual responses are grouped into classes, the possibility that among them are members of different functional classes is too often ignored. Measurement strategies are primarily discontinuous estimates of overall extent rather than continuous assessments of variability. The accuracy of measurement is solely associated with scores of interobserver agreements. Designs are regimented; reversals or multiple baselines are almost exclusively employed. Stability of the data is no longer an essential criterion of the effectiveness of the treatment. Groups of individuals are sometimes studied using inferential statistics to analyze the data; correlations rather than functional relations are becoming sufficient.

Influences beyond the change in purpose contributed to these changes in methodology. Among them were the conceptions of research brought to applied behavior analysis by the new professionals entering the field from other disciplines such as education and business. These professionals were trained in the currently predominant research mode of group designs and inferential statistics. Further, this methodological *zeitgeist* influenced many behavioral researchers to look to those traditions for their methodological strategies. Another important influence was that control was

not possible, or extremely difficult to achieve, in many of the applied settings where behavioral researchers went to solve problems. This difficulty brought the issue of cost-benefit analysis into the field; how much extra advantage was obtained by following the strict experimental procedures? Finally, some social problems were so severe that they required immediate relief. Even if little was learned of scientific importance, the work in the area was essential.

It is important to mention at this time that technological efforts are *not* useless or derived from poor judgment. A solid technology of behavior-change is an essential goal of a science of behavior. The solution of pressing social problems is as important, and may be ultimately more important, than the scientific study of behavior. While most often the technology advances with the science, there are occasions in which the science learns from the technology. Both science and technology, then, are worthwhile efforts. Any debate about science *or* technology is useless.

The issue needing discussion is where applied behavior analysis fits into this scheme. Looking at another set of distinctions may help clarify this question. There seems to be a growing confusion among many researchers in the field concerning the descriptions of science and technology in terms of basic and applied research. It seems that some scholars are equating a science of behavior with basic research and a technology of behavior-change with applied research. This is most definitely a confusion. The sole distinction between applied and basic research is in the selection of the dependent variable. Basic researchers investigate the influences of relevant independent variables on convenient responses. Applied researchers work with socially important human behavior. Both are part of a science of behavior. The distinction between such a science and a technology is quite different. Improving a social problem is a legitimate criterion of success in a technology. A science, however, must seek functional relationships.

The methodological requirements necessary to judge the success of a treatment are far different than those which will identify a functional relationship. If the applied analysis of behavior is a science, its experimental methodology must allow the determination of functional relationships. This statement brings the changes listed earlier in the experimental methodology of applied behavior analysis into question. Will experiments conducted with those methods uncover functional relationships? Are they sufficient for a science of socially important human behavior? If not, why not? If not, what can be done instead? Answers to those questions can only be derived from a thorough analysis of the special and most difficult demands human behavior places on the researcher.

OVERVIEW

J. M. Johnston and H. S. Pennypacker, in *Strategies and Tactics of Human Behavioral Research,* have conducted such an analysis. These authors have written a rigorous, comprehensive, and coherent volume oriented toward explaining and justifying the necessary components of an experimental methodology for a science of human behavior. The overall orientation of the book is drawn from the traditions established for the conduct of any science. The value of this book, however, is its clear dedication toward the particular problems posed by human behavior.

The book is directed at individuals who conduct research on human behavior as well as those who interpret or apply the findings of that research. However, the major concern of the book is with methods for examining the "lawful determinants of behavior in all settings rather than in modifying behavior for educational or social gain in particular settings" (xiii). The book discusses a science rather

than a technology of human behavior. In discussing this science, the authors have placed it in its historical perspective, examined the philosophical support for such a science, and explained the strategies and tactics for conducting the science. It is in this last task where they have addressed the necessary relationship between science and technology as well as the problematic issue of methodological differences between much current applied behavioral research and the requirements of a science of human behavior.

This book, as the authors explain in several places, is not a cookbook for conducting an experiment. It is intended to be "more than a conventional methodological treatise. We have tried to convey a complete perspective on the phenomena of human behavior that will guide the reader through the idiosyncrasies of any research endeavor" (v). A cookbook would not do the area of experimental methodology justice. Researchers need to know why to use certain methods as well as which methods to use. They need to learn the reasons for methodological decisions; at too many times during the conduct of research unique situations arise which require unique solutions.

The method the authors use to provide the knowledge and skills necessary for uncovering these unique solutions is to explain both the strategies and the tactics of each element of methodology. Strategies are "the overall plans, principles, or goals of scientific investigation" (xiv). These strategies are derived from particular philosophical considerations and the traditions established in the history of experimental science. Tactics are "the general methods and procedures necessary to implement the guiding strategies" (xiv). Tactics are derived from, and are logically consistent with, strategies.

Because a completely satisfactory account of the contents of the book is available only by reading it, this overview will consist of a necessarily brief commentary on each of the four strategies discussed within the book. Such a commentary will not include all the major issues contained in the book. It will omit some interesting and supportive analyses derived from the history of science, as well as discussions of some philosophical issues and the various types of, and relations among, behavioral research. The following commentary should serve to allow the reader to determine the major positions Johnston and Pennypacker defend.

In Chapter 1, four strategies establishing the science of behavior as a natural scieance are introduced. These strategies are its "distinguishing characteristics" (p. 15). They are essential if the science of behavior is to answer its important questions and lead to an effective technology. While the strategies are conceptually important in and of themselves, their primary value lies in the fact that they support certain methodological tactics and call other tactics into serious question. The four strategies listed by Johnston and Pennypacker are: (1) an emphasis on objective description of the subject matter, (2) an absolute unit-based measurement system, (3) the careful manipulation and control of variables required by an experimental analysis, and (4) the statement of functional relations.

The first strategy, relying on objective description, does not appear to be unduly complex on the surface but subsumes many essential issues. Most behavioral researchers are well aware of insuring that the behavior under study must be observable or measurable. They are also cautious about reifying hypothetical entities such as personality or the mind. Johnston and Pennypacker go beyond these issues, however, in discussing this strategy.

In Chapter 3, the authors introduce a definition of behavior on which this strategy, and much of the rest of the book, relies. Their definition is a

modification of one proposed by Skinner (1938). It states:

> The behavior or an organism is that portion of the organism's interaction with its environment that is characterized by detectable displacement in space through time of some part of the organism and that results in a measurable change in at least one aspect of the environment. (p. 48)

The authors discuss each component of this definition in terms of its impact on a science of behavior.

An elaboration of the importance of this definition occurs in Part II, *Measurement,* of their book. This elaboration demonstrates the interrelationships among the various parts of the book and the consistent approach the authors take to their whole topic. In Chapter 6, they expand on the implications of this definition in terms of particular definitions of response classes for a research study. They examine the differences between functional and topographical response classes and explain how their definition calls into question the tactic of "labelling classes of behavior in accordance with nonfunctional coding categories" (p. 102). While the authors find places where topographical definitions of response classes are useful, their primary warning concerns identifying response classes topographically where either they represent only part of a functional response class or serve to combine members from different functional response classes into the same category. Another important issue raised in this chapter is the increasingly common practice of studying the behavior of a group. With reference to their definition as well as other conceptual and practical concerns, this practice is clearly condemned.

The definition Johnston and Pennypacker propose for behavior leads directly into consideration of the second strategy for a science of behavior. The part of the definition requiring "detectable displacement in space through time" (p. 48) specifies particular tactics of measurement. In discussing the second strategy, absolute unit-based measurement, the authors begin in Chapter 4 with a brief, and therefore excusably incomplete, historical review of measurement. Two new terms are introduced which characterize the two major approaches to the measurement of human activity. These approaches are based on different conceptions "of the nature of the causes of variability" (p. 61) and are essential to understanding the requirement of this strategy.

Vaganotic strategies of measurement are those evident in group sources of data, while *idemnotic* strategies are evident in individual sources of data. Idemnotic measurement "incorporates absolute and standard units whose existence is established independently of variability in the phenomena being measured" (p. 71). "Vaganotic measurement refers to the creation of scales and units of measurement on the basis of variation in a set of underlying observations" (p. 64). Vaganotic measurement is based on the assumption of inherent variability, while idemnotic measurement is designed to assess imposed variability. The authors explain how idemnotic strategies are fundamental to all natural sciences and in that way to a science of behavior.

Only through idemnotic measurement can one detect "displacement in space through time" (p. 48) as it actually occurs. This detection, however, requires analysis of the dimensions of behavior which can be quantified in absolute units. In Chapter 7, the fundamental dimensions of behavior to be quantified are introduced and explained. These dimensions are countability, duration, latency, interresponse time, frequency, and celeration. Measurement tactics which do not account for these dimensions are unsuitable for a science of behavior.

Several other issues are mentioned within the discussion of this strategy. Tactics of observation and recording are examined in Chapter 8. One critical discussion concerns the problems presented by the widespread practice of discontinuous

measurement—sampling behavior within sessions through procedures such as time sampling and interval recording. In Chapter 9, an analysis of the problem of measuring behaviors that are less accessible is presented. This discussion provides useful tactics particularly for "cognitive behaviorists" who too often rely on self report (a modern version of introspection which lacks the rigorous training required in the original version) for their data. Finally, in Chapter 10, the stability and accuracy of measurement is examined. Among the most useful elements of this chapter is the commentary on the information actually provided by interobserver agreement scores. While this religiously required practice does provide one kind of information, Johnston and Pennypacker show how it does not provide the information relevant to its requirement by most journals.

The third strategy, experimental analysis, becomes important once the previous strategies have been satisfied. This strategy concerns issues of design, Part III of the book, but excellent design cannot overcome inadequacies of definition and measurement. Johnston and Pennypacker begin their comments on experimental analysis in Chapter 5. They present a theoretical overview which examines various approaches to design. They discuss the concept of chance and the introduction of statistics into experimentation. Their examination of the reasons why inferential statistics and group comparisons are inappropriate for an experimental analysis should serve to question the rationale of the many recent attempts by applied behavior analysts to statistically analyze single subject data.

Chapters 11 through 15 are an elaboration of strategies and tactics of experimental analysis. The authors return to the concept of variability emphasizing its importance and the need to assume extrinsic rather than intrinsic sources of variability. Through an analysis of steady states and transition states, a case is made that an experimental analysis must rely on demonstrations of control. Achieving this control requires carefully designed manipulation of independent variables. To demonstrate the various arrangements available to the researcher, a notational system for describing the possible elements of design is introduced. While this system is new, it is easy to understand and adds a graphic dimension which helps clarify the difficult process of adequate design.

Careful adherence to definition, measurement, and design provides data from which statements of functional relations, the fourth and final strategy, can be derived. To determine whether these relations can be obtained from particular sets of data requires careful interpretation of that data. In Part IV, *Interpretation,* Johnston and Pennypacker discuss various influences on a scientist's interpretation of data. They review the problems of displaying data and their commentary includes some pointed criticisms of some standard graphing practices in applied behavior analysis (e.g., obscuring discontinuity by presenting data as "consecutive sessions"). They discuss practices of reducing the raw data through methods of quantification and return to the discussion of how inferential statistics have no useful role in behavioral research. They conclude with a thorough discussion of how generality should be the standard against which the interpretation of data is judged.

In what is easily the most interesting chapter in the book (Ch. 18), the authors discuss particular sources of control which influence the interpretative behavior of the individual scientist. They discuss pre-experimental sources such as theory, literature, the scientist who conducted the research, and other extraexperimental contingencies (on p. 380 is an especially fascinating and sadly accurate discussion of fame and fortune in the world of the researcher); they also explain how measurement, design, and data con-

trol the interpretative behavior of the scientist. Most valuable is their discussions of criteria for determining the worth of a study and issues in scientific communication. On the latter point, Johnston and Pennypacker present a candid discussion on the decision to submit data to journals, and the review policies of those journals. Part of this discussion could serve to remind researchers that it should be as easy to publish *and* perish as it is to publish *or* perish.

COMMENTS

Johnston and Pennypacker have written an important book. Their explanation and justification of the particulars of method necessary for studying human behavior maintains such study in the firm traditions of experimentation in the physical and natural sciences. Their effort is not unique to science; for example, Claude Bernard (1865/1957) placed medical research in that tradition and Murray Sidman (1960) solidified the position of a laboratory science of behavior.

The authors' effort is valuable for it is unique to a science of *human* behavior. Knowledge of the traditions of science, in general, or of the particulars of a different science is usually insufficient to aid the researcher in solving the unusual problems presented by his or her own subject matter. In that sense, *Strategies and Tactics of Human Behavioral Research* is more than a revision of earlier works on experimental methodology. It consistently extends and in some places definitely improves earlier efforts.

While this book is impressive, it is not perfect. Some analyses of the philosophical and logical support for the positions advocated in the book would be improved by inclusion of some of the more recent philosophical work on induction. The lengthy illustration of the efforts toward replication of timeout is unnecessary. There is probably an overemphasis on the value of logarithmic scales for the display and analysis of data. Finally, in a few places current tactics of research are criticized but new tactics are not suggested to replace them.

These criticisms are minor and in no way should they be interpreted as hindrances to the value of the book. In fact, of all the recent books on methodology available to applied behavior analysts, this one is the most useful. Some of the books available cover only certain parts of experimental methodology; others discuss only the tactics available to the researcher. Johnston and Pennypacker offer a full analysis of this area through their complete discussions of strategies as well as tactics.

In fact, these authors deserve congratulations for writing a book that can be used as a text rather than one intended only to be a text. Throughout this review I have called this volume a book rather than a text, for texts today are often just watered-down amalgams of eclecticism. All topics are covered from all viewpoints in hopes that large class adoptions will result. Johnston and Pennypacker have taken one position—the requirements of an experimental natural science—and have explained and justified that position. Books like this one are rare, in part, because few publishers will take a chance on them. Lawrence Erlbaum, however, has a growing reputation as a publisher of excellent books in many fields and deserves congratulations.

While this book was not written as the usual text, it can and should be used as a text. It is well organized, clear, contains many figures, and each topic is illustrated with examples, often necessarily hypothetical, of human research. It could be used in courses for advanced undergraduates but will probably be most useful for graduate classes in experimental methodology. Students in basic research, applied research, or technologically oriented programs will profit from mastering the contents of this book.

Professionals already in the field of applied behavior analysis will also benefit

from mastering this volume. It will serve to introduce new issues and remind us of some we have forgotten. Researchers can use the extensive author-subject index to locate areas of the book necessary to help plan or interpret their studies. Teachers will find useful rationales for points they make in class. Journal editors can evaluate their editorial policies against the criteria for scientific research this book presents. In short, I can think of no reason why an often used copy of *Strategies and Tactics of Human Behavioral Research* should not sit next to Sidman (1960) on the bookshelf of every behaviorist.

This is not to say that everyone will agree with all the positions defended by Johnston and Pennypacker. I think this book will be somewhat controversial. It could be argued that it is too difficult and time consuming to do this type of research. Some will say that important problems in uncontrollable settings could not be addressed.

Many researchers will find that the positions defended in this book make them uncomfortable, in part because of the above arguments but also because the research they have been publishing as authors or accepting for publication as editors strays from the dictates of this view of a science of human behavior. If this discomfort leads in any way to displeasure or antagonism, I offer only the advice of Bertrand Russell (1961): "If an opinion contrary to your own makes you angry, that is a sign that you are subconsciously aware of having no good reason for thinking as you do" (p. 94). Marshall your arguments, for in this book Johnston and Pennypacker have convincingly presented theirs.

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